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Economic valuation of the public benefits of marine protection and sustainable management of the North Sea

Part II

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Abstract

The main objective of this study is to assess the public benefits associated with the protection and sustainable management of the North Sea. For this purpose, first 600 face-to-face beach interviews were carried out with a non-representative sample of beach visitors in August 2006 at 10 different beaches along the Dutch North Sea coast and on the island of Texel, using a structured questionnaire design. As a follow-up, a more representative mail survey was carried out a few months later in October targeting 7000 randomly selected households in the Netherlands. The results from the first face-to-face survey were published in September 2006. This report presents the results of the follow-up survey. The response rate of this mail survey is low: only 17 percent despite the use of a financial incentive to stimulate households to complete and return the questionnaire. Nevertheless, the sample is considered fairly representative for the rest of the Netherlands.

Besides a baseline scenario, respondents were presented with two possible future development scenarios for the protection and sustainable management of the North Sea: one where ecologically valuable and vulnerable areas are designated as protected marine parks with limited economic activity and one where the same areas are fully protected and no economic activities are allowed at all. The basic idea behind the survey is simple. A simple public choice model is introduced to households in which they are asked as tax payers to decide which future management scenario of the North Sea they consider worth pursuing and most valuable. Choosing continuation of the current situation (baseline scenario) is also possible.

The outcome of the public choice model is a preference for some level of protection and sustainable management of the North Sea. Not only does a majority of the sample consider this important, they are also willing to pay extra for this through their income taxation. Average willingness to pay for protection of the North Sea is between 70 and 80 euro per household per year. Aggregated across the whole Dutch population, a total economic value results of roughly between 220 and 270 million euros for a protected status of the North Sea with limited use and between 165 and 210 million euro for a fully protected status of the North Sea. These estimated non-market benefits seem to exceed the first cost assessments of the implementation of a European Marine Strategy for the North Sea. Discounted over for example a 10-year time period at a conventional discount rate of 4 percent, a present value is found between 1.4 and 1.8 billion euro for the latter management option and between 1.9 and 2.3 billion euro for the former option.

1. Introduction

The European Marine Strategy (EMS) is one of the thematic strategies in the sixth European Environmental Action Plan, aiming to achieve a sustainable balance between the use and protection of all European marine areas. In this context, the Dutch Government has committed itself to carry out an impact assessment in order to assess the social costs and benefits associated with the implementation of the EMS. A preliminary assessment of the costs of additional EMS measures to protect the North Sea shows that these costs are limited, ranging between 15 and 135 million euros annually. Possible types of measures include the reduction of chemical contaminants, which cause *inter alia* eutrophication of seas, the protection of ecologically vulnerable zones, sustainable management of fish stocks and the reduced risk of ecosystem disasters (e.g. oil spills). This implies an increase of the current annual costs between one and eight percent. Current policy is mainly aimed at the reduction of the inflow of chemical and nutrient pollution into the North Sea through the main rivers. Like the Water Framework Directive (2000/60/EC), the draft version of a European Framework Directive for the Protection of the Marine Environment does not include concrete environmental objectives. It merely states that it aims to reach a good environmental status.

The main objective of this report is to provide a first preliminary assessment of the public benefits associated with the implementation of a Marine Water Framework Directive (MWFD) and the achievement of good environmental status in the North Sea. This benefits assessment can be used in a pre-feasibility assessment of the costs and benefits of implementation of the MWFD in the Netherlands. Besides more sustainable use values, it is also, or perhaps even more so (future) option values and non-use values, which are expected to make up a large share of the public benefits associated with reaching good environmental status in the North Sea.

In order to assess the public benefits of a more sustainable balance between the use and protection of the North Sea, a large-scale contingent valuation (CV) mail survey study is carried out in the Netherlands. This study, targeting 7000 randomly selected households in the Netherlands, supplements the previous six hundred face-to-face interviews carried out along the North Sea coast with Dutch beach visitors during the summer of 2006 on several beaches along the North Sea coast and the island of Texel (see Brouwer et al., 2006).

CV is the only method available, which is able to assess both the use and non-use values associated with reaching good environmental status in the North Sea. CV is a survey-based approach, which is able to elicit useful, policy relevant information about public perception, attitudes and opinions about environmental policy such as the new MWFD and expected changes in the natural environment. In this sense, the CV method is very similar to a public poll. However, besides information about public opinion of the urgency and priority to be given to the protection of the North Sea, the CV method also allows for the assessment of public willingness to pay (WTP) for the proposed policy. Taxpayers are asked how they feel about proposed policy measures and whether they feel the proposed policy is worthwhile funding. In this way, the method provides useful information to policy and decision-makers by informing them whether the public at large

(as tax payers) believes that the implementation costs of the new policy are worth taking and/or good value for money given the expected and perceived benefits associated with the protection of the North Sea. This information can help policy and decision-makers decide whether the implementation of a MWFD is worth further pursuing or not.

For a more detailed discussion about the background of the current state of and pressures on the North Sea, the content of the European Marine Strategy and the way existing policy plans have been converted into different valuation scenarios in the CV questionnaire, including the overall questionnaire design, the reader is referred to the first report of the face-to-face beach interviews (Brouwer et al., 2006). This paper reports upon the large-scale mail survey results.

The remainder of this report is organized as follows. Chapter 2 presents the sampling procedure and the response rate. The survey results are presented in chapter 3, including the demographic and socio-economic characteristics of the survey sample population, their perception and attitude towards the current state of the North Sea and the perceived benefits of a more sustainable management and protection of the North Sea. Finally, chapter 4 concludes and provides recommendations for future policy.

2. Sampling procedure and response rate

A total of 7,000 randomly selected households across the Netherlands received the thoroughly pre-tested questionnaire during the summer of 2006 in their mail the third week-end of October 2006. The random addresses are obtained from Cendris (www.cendris.com), who manages an enormous database of Dutch consumer households. The questionnaire was sent together with an accompanying letter from the Institute for Environmental Studies (IVM, Vrije Universiteit Amsterdam, and a pre-stamped return envelope. The questionnaire follows Dillman's (1978) total design method, and is sent as a booklet. The front page contains a colour painting of the North Sea and included in the questionnaire is a one-page colour information sheet.

The randomly selected addresses are based on the distribution of households across the twelve provinces in the Netherlands (Table 2.1). The provinces Noord-Holland, Zuid-Holland and Zeeland are of particular interest in view of the fact that they are bordered in the west by the North Sea. Given the relatively low number of inhabitants in the most southern located province Zeeland, the number of households in this sample was increased at the expense of the relatively densely populated provinces North and South Holland.

The response rate is 16.7 percent ($n=1171$). This is low, also given the fact that a financial incentive was used to stimulate households to complete and return the questionnaire as soon as possible. The first 100 returned questionnaires received a gift coupon worth 25 euro. The distribution of respondents across municipalities and provinces is presented in Figure 2.1. The response per province is determined based on the postal code respondents were asked to fill in for their place of residence. Thirty-two respondents (2.7%) did not give their place of residence and can therefore not be linked to a specific province in Table 2.1 (hence the reason why the total number of observations is 1139).

As expected, Zeeland is overrepresented in the sample, whereas Zuid-Holland is underrepresented. Surprisingly, Noord-Holland is proportionally represented to its share in the total population. Also the other provinces are, as expected, represented more or less equally to their share in the total population.

Province	Total number of households in the population*	Relative share	Total number of households in the sample	Relative share	Response	Relative share
Groningen	268,377	3.8	260	3.7	45	4.0
Friesland	273,556	3.9	260	3.7	48	4.2
Drenthe	200,655	2.8	190	2.7	34	3.0
Overijssel	457,070	6.4	430	6.1	59	5.2
Flevoland	144,487	2.0	150	2.1	23	2.0
Gelderland	818,267	11.5	770	11.0	117	10.3
Utrecht	511,161	7.2	480	6.9	84	7.4
Noord-Holland	1,207,320	17.0	1,020	14.6	194	17.0
Zuid-Holland	1,546,553	21.8	1,020	14.6	148	13.0
Zeeland	162,107	2.3	1,020	14.6	191	16.8
Noord-Brabant	1,009,021	14.2	940	13.4	138	12.1
Limburg	492,391	6.9	460	6.6	58	5.1
Total	7,090,965	100.0	7,000	100.0	1139	100.0

* Source: Statistics Netherlands (2006).

Table 2.1: Total number of households in the Dutch population and the sample per province and the response per province

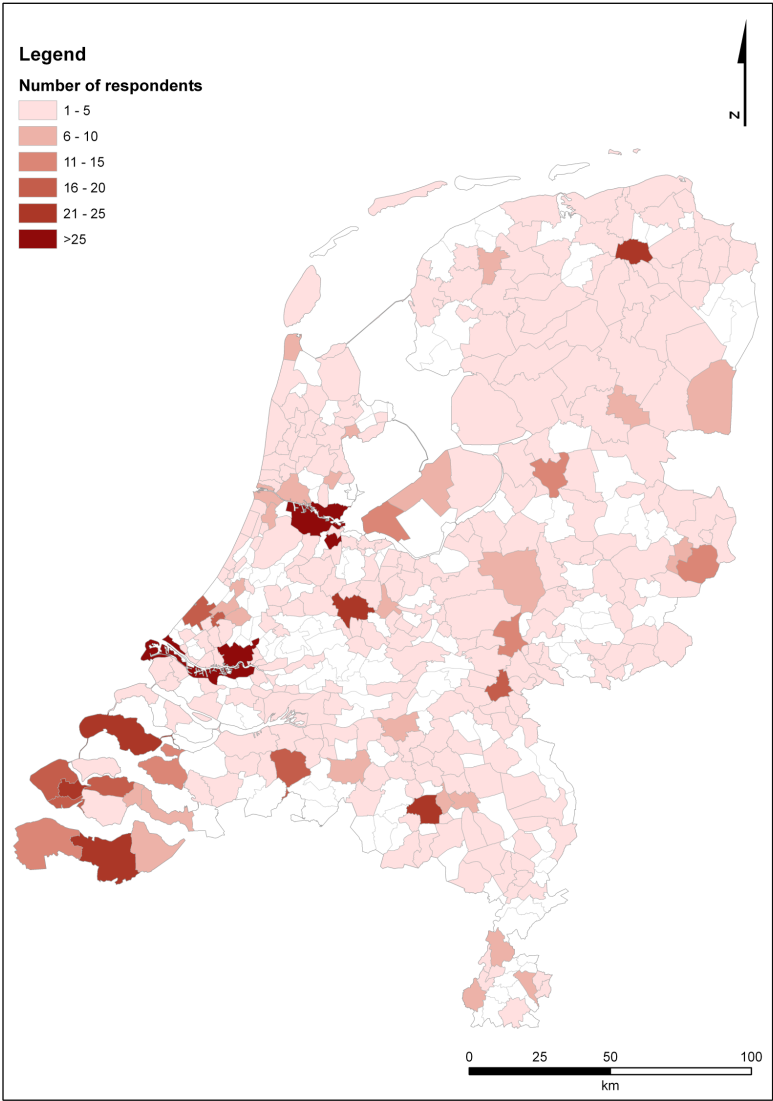


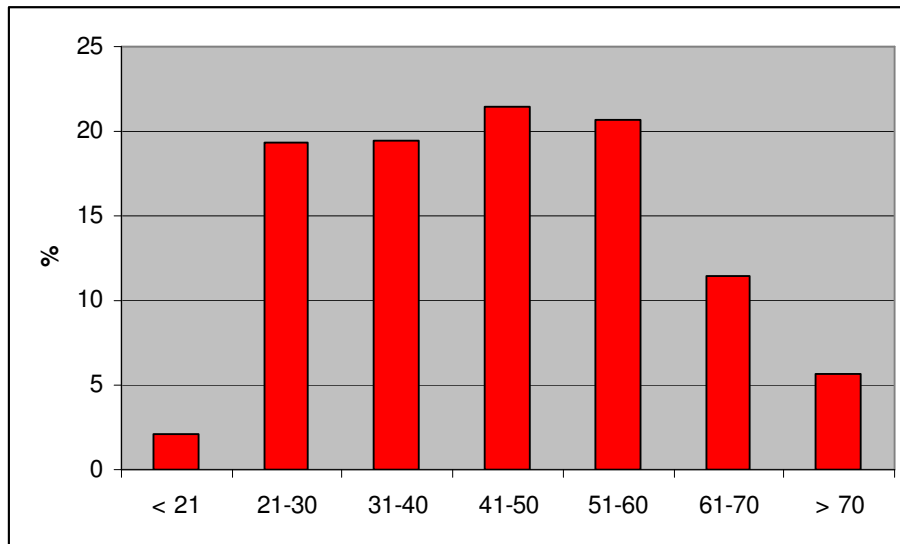
Figure 2.1: Spatial distribution of respondents across municipalities in the Netherlands.

3. Results

3.1 Demographic and socio-economic respondent characteristics

About half of the respondents is male (51%) and half female (49%). The average age is 45 years. This is also the median value. The distribution of respondents across age groups is presented in Figure 3.1. Respondent age varies between 18 and 96 years¹.

Figure 3.1: Distribution of respondents across age groups



All respondents have the Dutch nationality and most are originally also born in the Netherlands (95%). The share of respondents whose parents were born elsewhere is slightly higher, namely 8 percent.

More than one quarter of the sample population comes from a single person household (Figure 3.2). This is lower than the national average where 35 percent of all households forms a single person household (Statistics Netherlands, 2006). About one third shares a household with one other person. The average household size is 2.4, which is approximately the same as the national average of 2.3 (Statistics Netherlands, 2006). Forty-two percent of the multiple person households has one or more children. This is lower than the national average of 55 percent (Statistics Netherlands, 2006).

Eighty-five percent of the sample population has finished secondary school, though at different professional levels as can be seen in Figure 3.3. Only two percent went to primary school only, and almost 15 percent has a university degree.

¹ One 13-year old and two 17-year old respondents were excluded from the database. The survey is targeted at respondents who are 18 years old or older.

Figure 3.2: Distribution of respondents across household size

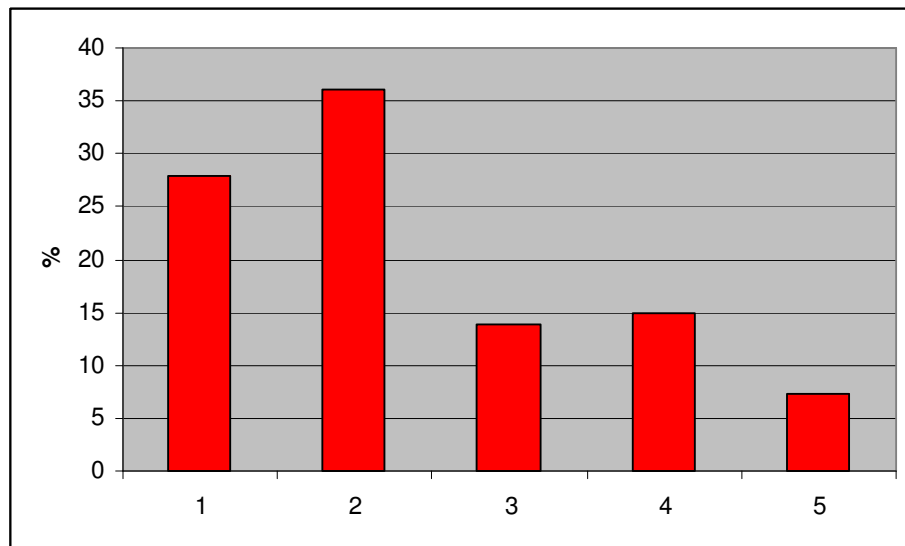
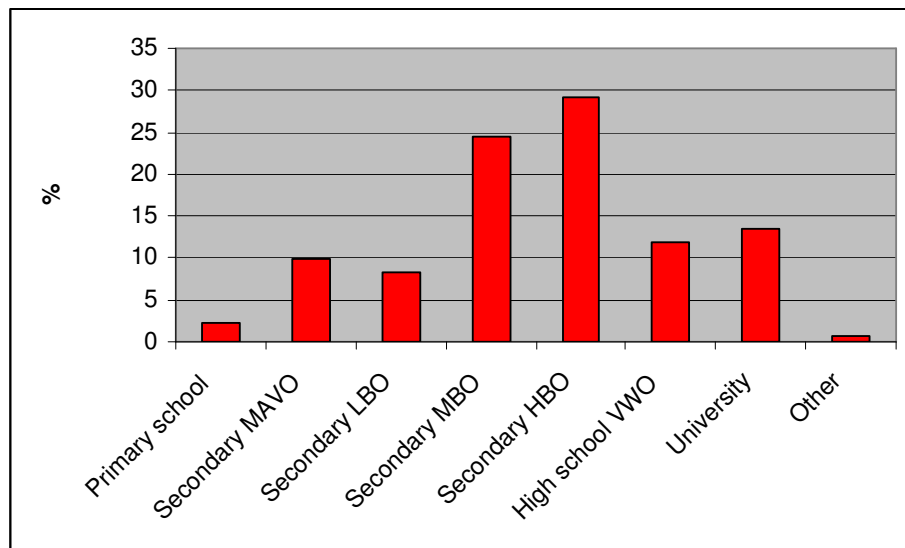


Figure 3.3: Distribution of respondents across education level



Half of the sample population (54%) is half or full time employed (Figure 3.4). Almost 10 percent is an independent employer. Sixteen percent of the sample population is retired and 4 percent is student. Six percent is housewife and 3.5 percent is currently unemployed.

The distribution of respondents across different occupational sectors is presented in Figure 3.5. A relatively high share of the sample population is employed in health care (16%), followed by the public (Government) sector (11%), industry and education (both 9%). The share of respondents employed in sectors, which are directly or closely linked to the North Sea such fishery (0.7%) and commercial shipping (1.7%) corresponds more or less with their share in the total population (Statistics Netherlands, 2006).

Figure 3.4: Distribution of the sample population across occupations

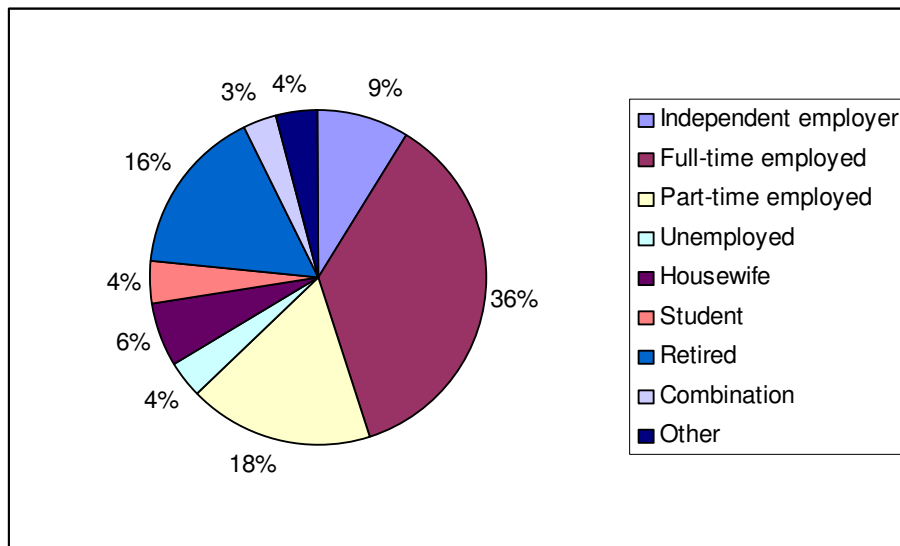
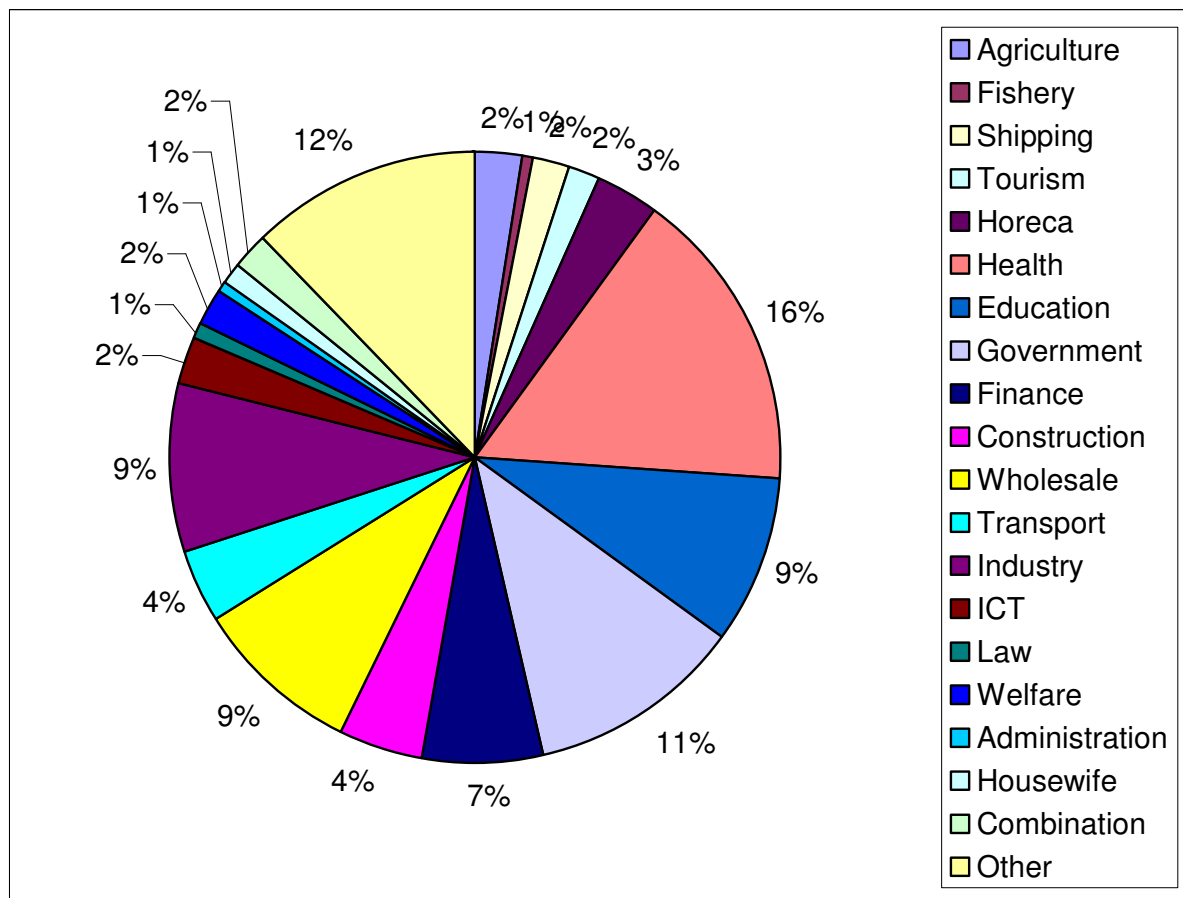
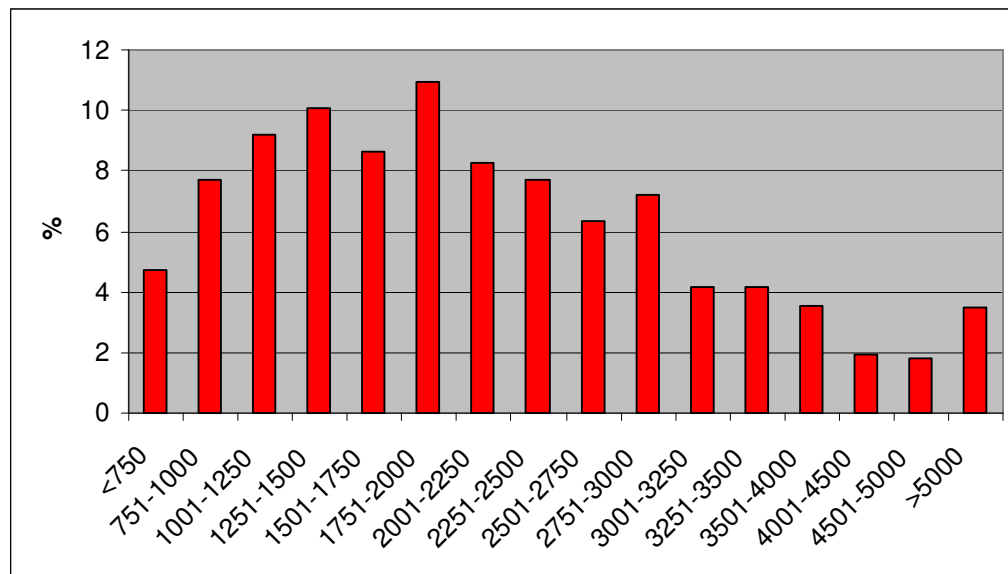


Figure 3.5: Distribution of the sample population across occupational sector



The distribution of respondents across different income levels is slightly biased towards the lower income groups (Figure 3.6). Half the sample population has a maximum net household income of 2000 euros, while three quarters earns maximum 2,750 euros per month. Ten percent has a net monthly household income higher than 3,500 euros. The median value is 1,875 euros per month. Average net household income is 2,250 euros per month. Multiplied by 12 this results in annual disposable income of 27,000 euros, which corresponds with the national average (Statistics Netherlands, 2006). Mean income is 1,545 euro for a single person household and 2,530 euro for a multiple person household. Households with children earn net 2,500 euros per month while multiple person households without kids earn slightly more, namely 2,550 euros per month.

Figure 3.6: Distribution of the sample population across income groups



3.2 Beach visits and activities

Eighty-five percent of the sample visits the beach at least once a year (Figure 3.7). Fifteen percent indicates never to visit a North Sea beach. The average frequency of visiting the most popular beach is ten times per year. The median value is much lower, namely 3 times a year. As perhaps expected, significant differences in beach visits are found across provinces (Figure 3.8)². Inhabitants of the provinces that are bordered by the North Sea visit the beach significantly and substantially more often than inhabitants from other provinces. The highest visit frequency is found in Zeeland (on average 25 times per year).

² The outcome of the Kruskal-Wallis chi-square test statistic is 260.598 ($p < 0.001$).

Figure 3.7: Average number of beach visits throughout the year

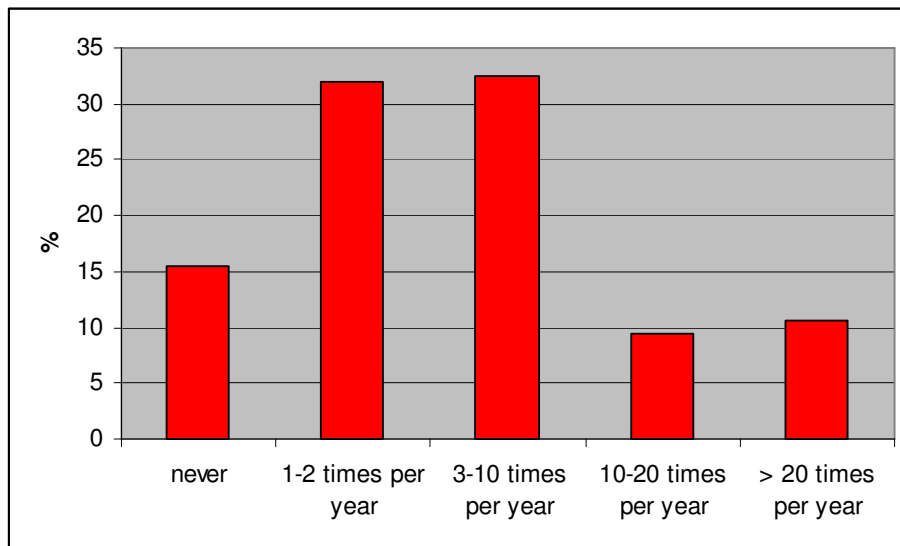
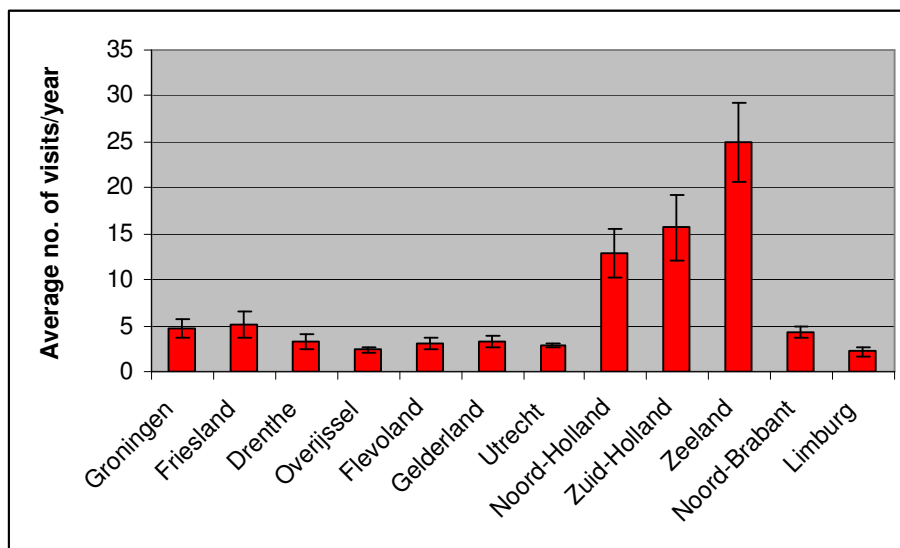


Figure 3.8: Average number of visits to the respondent's most popular beach throughout the year (including standard error of the mean value)



Scheveningen is by far the most popular North Sea beach in the Netherlands (Table 3.1). Almost one in every fifth respondent lists Scheveningen in Zuid-Holland as their most popular and most frequently visited beach, followed by Zandvoort in Noord-Holland and Noordwijk in Zuid-Holland again. Scheveningen is visited, on average, four times a year by the respondents. Again significant differences are found between respondents from different provinces³.

³ The outcome of the Kruskal-Wallis chi-square test statistic is 55.606 ($p < 0.001$).

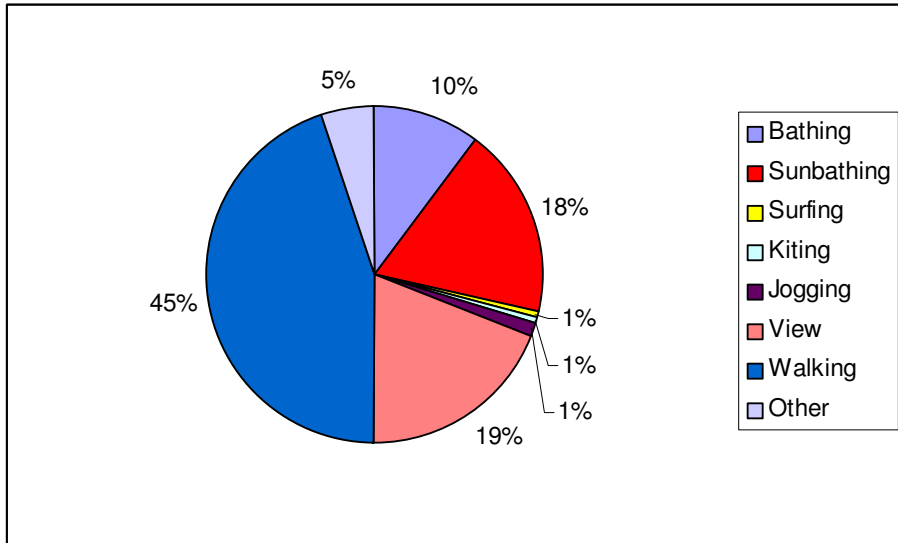
Table 3.1: Most popular North Sea beaches in the Netherlands

Beach	Share of visitors indicating this is their most popular beach*
Wadden sea islands	7.3
<i>Province Noord-Holland</i>	
Bergen aan Zee	2.9
Bloemendaal	3.3
Castricum aan Zee	1.3
Callantsoog	1.4
Egmond aan Zee	3.9
Ijmuiden	1.8
Zandvoort	8.0
<i>Province Zuid-Holland</i>	
Hoek van Holland	2.5
Katwijk aan Zee	2.2
Kijkduin	2.3
Noordwijk aan Zee	5.7
Scheveningen	18.5
<i>Province Zeeland</i>	
Cadzand	3.1
Dishoek	1.4
Domburg	1.6
Oost-Kapelle	1.4
Ouddorp	1.0
Renesse	1.3
Vlissingen	3.4
Vrouwenpolder	1.6
Zoutelande	1.1
<i>Other</i>	22.9
Total	100.0

* Beaches, which are most popular with at least 10 respondents are included in the table only.

Walking along the beach is the most popular activity when visiting the beach mentioned by 45 percent of the beach visitors (Figure 3.9), followed by looking at the seaside view (19%) and sunbathing (18%). Bathing is the fourth most popular activity.

Figure 3.9: Most popular beach activities

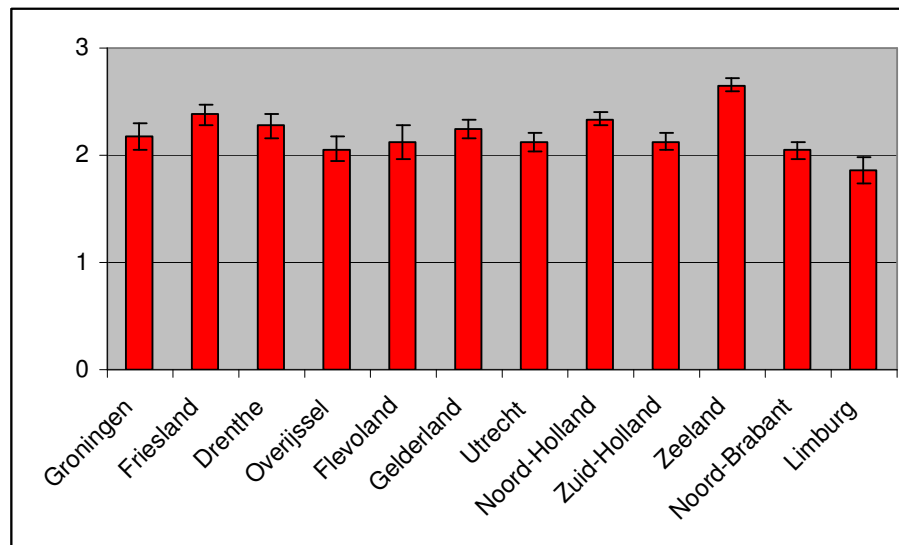


3.3 Perceptions and attitudes

When asking respondents how they perceive the North Sea water quality, only 35 percent say it is clean. Almost 15 percent say it is not clean, while 10 percent do not know and 40 percent say not clean, but also not unclear. Small but statistically significant differences are found between provinces when excluding the don't know (DK) answers (Figure 3.10)⁴. Beach visitors in Zeeland rate North Sea water quality highest, a result we also found in the face-to-face beach interviews. Seawater quality is considered poorest by respondents living in the east-southern province Limburg.

A relatively high share of 43 percent of all beach visitors is unable to say whether the North Sea water quality improved or deteriorated over the past ten years (Figure 3.11). This finding corresponds with the result that more than half of the respondents feels insufficiently informed about the quality of the North Sea. Only a quarter of the sample population feels sufficiently informed. Furthermore, about one quarter believes that the water quality has improved, whereas one in every fifth respondent observed no changed and more than 10 percent think seawater quality has deteriorated.

Figure 3.9: Beach visitor perception of current North Sea water quality

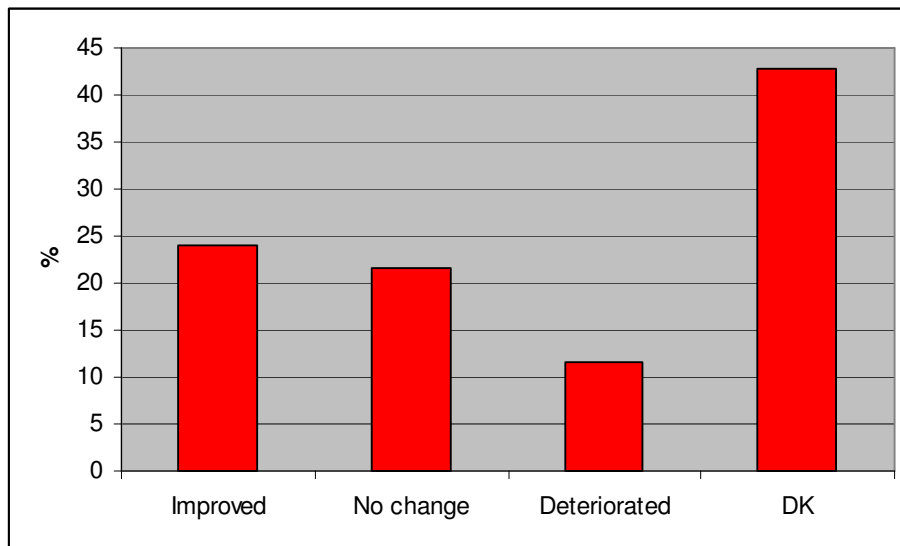


Explanatory note:

Average score on Likert scale between 0 and 4, where 0 means not clean at all and 4 means very clean.

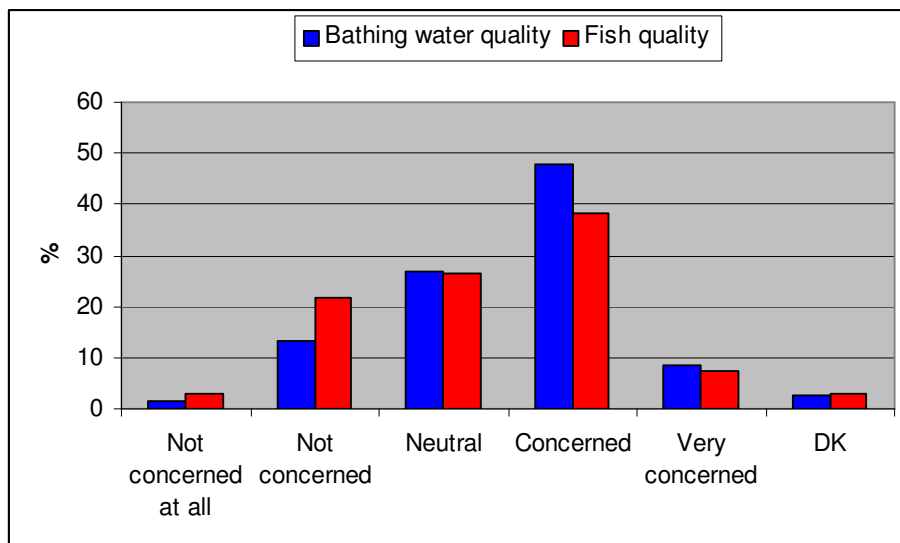
⁴ The outcome of the Kruskal-Wallis chi-square test statistic is 36.425 ($p < 0.001$).

Figure 3.11: Beach visitor perception of North Sea water quality changes over the past decade



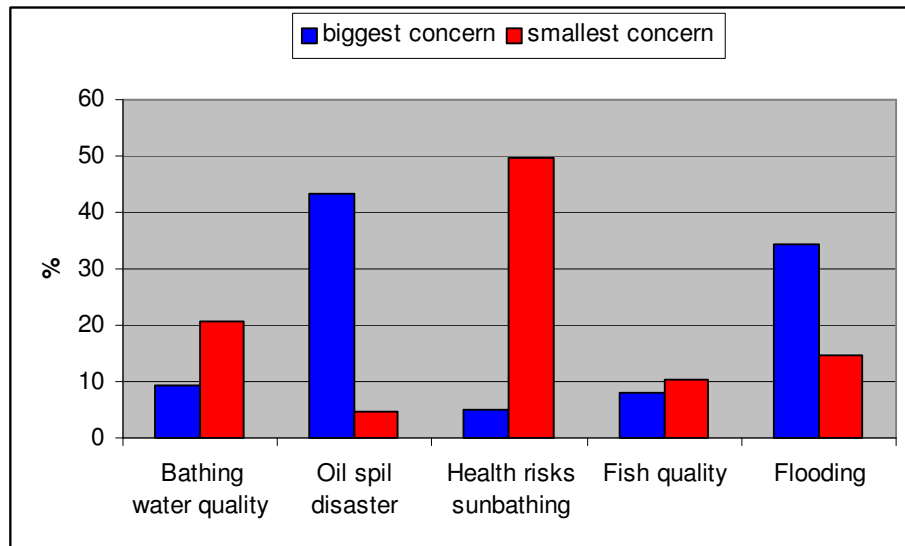
Fifty-five percent is concerned to very concerned about the North Sea bathing water quality (Figure 3.12), one of the possible reasons why bathing scores relatively low as beach activity (besides other factors such as bad weather and cold water). Although almost 80 percent of the sample eats fish, 45 percent is concerned or very concerned about its quality. Fifteen percent eats fish, but has no idea where the fish comes from. Almost 10 percent never eats fish from the North Sea. Two thirds of all respondents is willing to pay extra for better quality fish caught in the North Sea.

Figure 3.12: Public perception of North Sea bathing water and edible fish quality



Another interesting finding is the rating of a number of North Sea related risks (Figure 3.13). Oil spills are rated highest by most respondents (43%), followed by climate change and flooding (34%). The same results were found in the face-to-face interviews with beach visitors. The health risks of sunbathing are of least concern. Half of the respondents rated this risk as lowest. Corresponding more or less with the results presented in Figure 3.12, bathing water quality is considered of least concern by approximately 20 percent of the sample population.

Figure 3.13: Public concerns about possible North Sea related risks



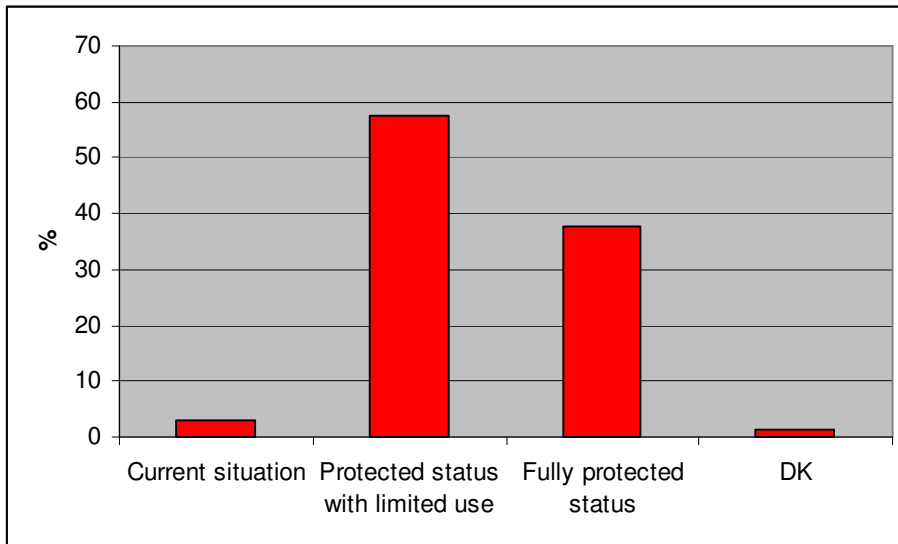
3.4 Public willingness to pay for marine protection

3.4.1 Willingness to pay and public benefits of marine protection

A majority of 95 percent of the total sample population prefers some degree of protection for the North Sea. Most respondents (58%) prefer a protected status with limited use (Figure 3.14). As many as 38 percent prefers a fully protected status for selected marine parks on the North Sea. Although less people preferred a fully protected status for the North Sea, the results found here correspond largely with the results found for the face-to-face interviews. Not only do respondents consider it important that the North Sea is somehow protected, two thirds is also willing to pay in principle for this.

The most important reasons why respondents are willing to pay are their concern for future generations (stated by almost 40 percent of the respondents as their main reason) and the environment in general (stated by almost 30 percent as their main reason) (Figure 3.15). Stated WTP hence seems to be driven primarily by non-use concerns and to some extent possible also what has been labelled the purchase of moral satisfaction in the CV literature (Kahneman and Knetsch, 1992).

Figure 3.14: Public preferences for alternative North Sea scenarios



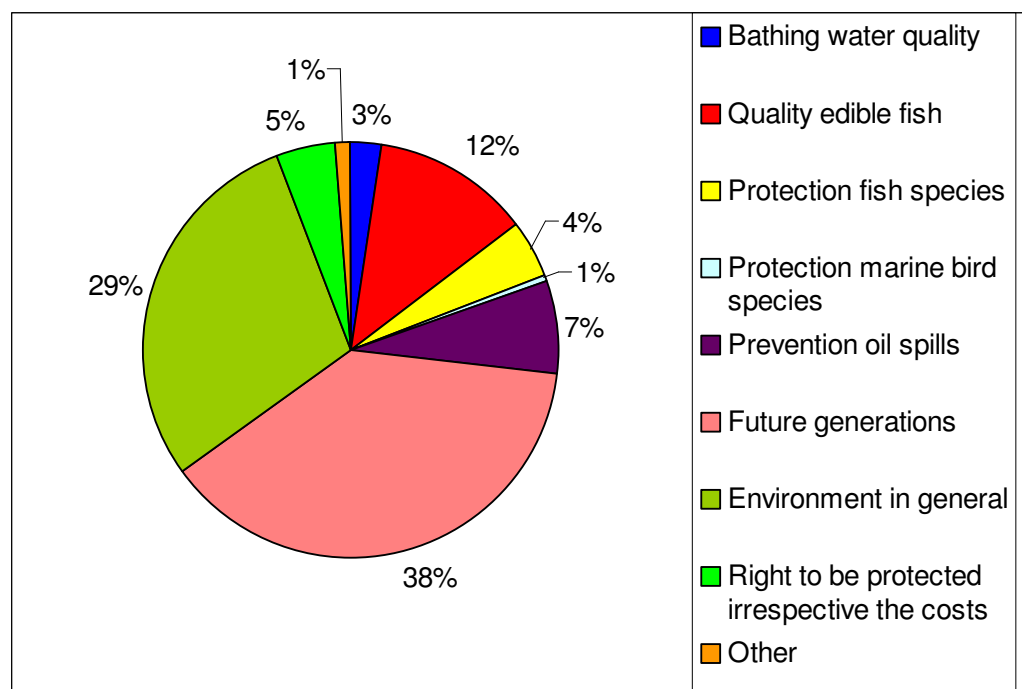
Despite efforts to focus respondents' attention in particular on the protection of specific natural areas on the North Sea (including the coast), more general concerns about the environment and future generations dominate the responses. North Sea specific considerations like fish and bathing water quality, prevention of oil spills, or the protection of fish and bird species play a role in respondent replies, but are mentioned by less than 30 percent of all respondents as their prime reason of interest and reason for paying.

The results above can be interpreted such that it seems that we elicited primarily some general commitment to an environmental cause instead of a specific to the North Sea related economic value. However, less than one percent of those stating a positive WTP in principle for their most preferred future situation of the North Sea state that they are willing to do so because they like to give to good causes. Also the presence of possible lexicographic preferences (e.g. Spash and Hanley, 1995) are dismissed based on the finding that less than 5 percent of the sample population feels that the North Sea has a right to be protected irrespective of the costs to society. Almost sixty percent of the respondents who are willing to pay in principle feel some degree of responsibility for the current state of the North Sea and 80 percent agree with the statement that 'money invested in the North Sea now will pay itself back in the long term'.

A similar result is found when analyzing responses to the question which types of values are considered most important for households to contribute to the protection and sustainable management of the North Sea. A quarter considers use and non-use values equally important, where use values are described as 'the value attached to my own health in relation to bathing in the North Sea and eating fish from the North Sea', and non-use values as 'the value attached to nature, wildlife and the environment and future generations'. Twenty-five percent says that these latter non-use values are most important, whilst overall almost 70 percent considers non-use values more important than use values. A significant difference is found here between respondents who prefer a future pro-

tected status with limited use and beach visitors who prefer a fully protected status⁵. The latter score higher on the applied use versus non-use scale than the former⁶.

Figure 3.15: Most important reasons for a positive WTP



Before we present the WTP results in more detail, we first discuss the reasons why respondents are not willing to pay.

⁵ The Mann-Whitney Z value is -4.889 ($p < 0.001$).

⁶ Respondents were asked to rate the most important reason why they are willing to pay for the protection of the North Sea using the following semi-itemized rating scale:



3.4.2 Reasons why people do not want to pay

Three hundred and seventy-nine respondents (32%) refuse to pay in principle for the protection of the North Sea. Separate questions are asked to find out in as much detail as possible why. Based on the reasons people state why they are not willing to pay, they are either classified as legitimate zero bidders or protest bidders. The reasons why respondents refuse to pay in principle for their most preferred future situation are presented in Table 3.2.

Table 3.2: reasons why beach visitors are not willing to pay for the protection and sustainable management of the North Sea

Reason why beach visitors are not willing to pay	Share of total refusals (%)
<i>Economically expected reasons</i>	
Preference for continuation of the current situation	1.6
Protection not important	0.8
Income too low	24.3
Current situation good enough	2.2
Other things more important	4.6
Reallocation current tax money	23.8
Other reason	2.6
Sub-total	59.9
<i>Protest reasons</i>	
Protection through law, not by asking people to pay	34.3
Polluter should pay	3.2
Other protest reason	2.6
Sub-total	40.1
Total	100.0

A distinction is made between economically expected reasons, resulting in legitimate 'zero bids' and protest reasons, that is reasons where respondents basically protest against the imposed market construct by the hypothetical WTP question (see for example Jorgensen et al., 1999 or Meyerhoff and Liebe, 2006). Typical protest reasons include 'the polluter or beneficiary should pay', or respondent disbelief that the money will actually be spent on the North Sea. In this study, most protesters argue that the North Sea

should be protected by law, not by asking people to pay for its protection. This is followed by the polluter and user (commercial shipping and fishery) should pay.

A large share of ‘protest bidders’ can seriously invalidate the CV study and WTP question for this specific environmental problem or issue. However, the share of protest bids is relatively limited in this case study compared to the total sample size. Although 40 percent of the refusals are based on a protest reason as shown in Table 3.2, the share of protest reasons in the whole sample is 12.5 percent. This is higher than the share of protest responses found in the face-to-face interviews, but still considered acceptable (see Brouwer (2006) for guidelines on acceptable protest rates).

Looking at the economically expected reasons, these typically relate to low or no preferences, meaning that the good has little or no incremental value to the respondent in question, or income constraints and the availability of substitution goods, also implying that the respondent in question prefers to spend his limited income on other things than the proposed management measures to protect the North Sea. This too is interpreted such that the marginal value of the proposed environmental changes is zero. The economically expected reasons are converted in zero bids in the analyses presented below. Protest bidders are excluded from further analysis.

3.4.3 Average willingness to pay

As in the face-to-face interviews, respondents are asked a dichotomous choice (DC) WTP question. Eight different bid levels are used, ranging from 5 euro to 250 euro per household per year. Mean WTP measures for DC WTP responses are inferred from the statistical cumulative probability distribution function (CPDF) (Hanemann and Kaninen, 1999). The cumulative probability distribution functions for the two different management options are presented in Figure 3.15. Based on these functions, the average WTP values are derived. For this, we use the conventional logistic probability model approach as per Hanemann (1984). The reduced form of the logistic probability or logit model is (e.g. Langford and Bateman, 1993):

$$\Pr[y_i=1] = \frac{e^{\beta'x}}{1 + e^{\beta'x}}$$

where $\Pr[y_i=1]$ is the probability that a respondent says ‘yes’ to a specific bid amount. Beta (β) is a vector of variable parameters to be estimated, while x is the corresponding vector of explanatory variables. The error terms of the logit model are assumed to be normal distributed with zero mean and variance of one. Mean WTP is found by dividing the estimated constant by the negative of the slope parameter belonging to the bid vector (Hanemann, 1984). The average WTP values are presented in Table 3.2.

Figure 3.15: Cumulative probability distribution functions for two different North Sea management scenarios: protected status with limited use and fully protected status

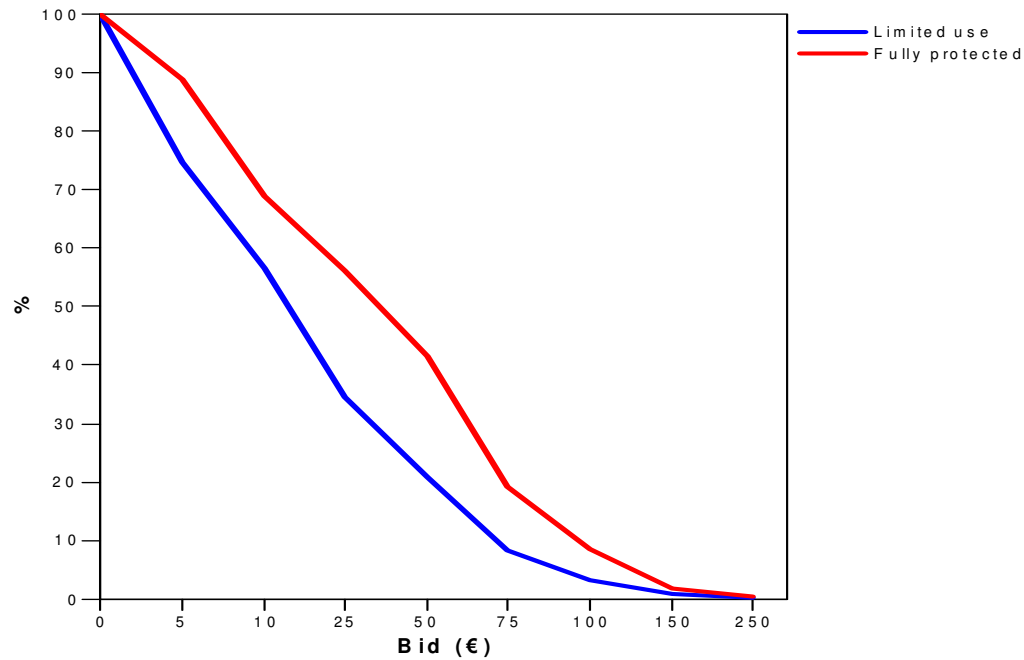


Table 3.2: Average single bound WTP results (in €/household/year) for both North Sea management scenarios

	Protected areas with limited use	Fully protected areas
Mean WTP	75.7	112.4
Standard error	19.9	27.5
95% confidence interval	36.7 – 114.6	58.5 – 166.3
Number of observations	592	396

As for the face-to-face interviews, we find that average WTP is significantly higher for a fully protected North Sea than for a protected status with limited use. The estimated standard errors and corresponding variation coefficients are substantial (25%), as can also be seen from the relatively wide 95 percent confidence intervals.

Following the DC WTP question, respondents are also asked for their maximum WTP explicitly in an open-ended question. This yields another 732 observations ranging from 0 to 600 euros per household per year. Mean WTP and their 95 percent confidence intervals for the two North Sea management scenarios are presented in Table 3.3. From Table 3.3 two important observations can be made.

Table 3.3: Average maximum open-ended WTP results (in €/household/year) for both North Sea management scenarios

	Protected areas with limited use	Fully protected areas
Mean WTP	70.0	79.8
Standard error	3.5	4.7
95% confidence interval	63.1 – 76.9	70.6 – 89.0
Number of observations	424	308

First, the estimated mean WTP values are lower for both management scenarios. Especially average WTP for a fully protected status is substantially lower based on the open-ended WTP results. Mean WTP for a fully protected status is still significantly higher than mean WTP for a protected status with limited use⁷, but the difference is much smaller than for the DC results. Secondly, the estimated open-ended WTP values are much more accurate than the DC WTP values. This is made clear by the smaller confidence intervals and the much lower variation coefficient (5%).

Comparing these stated maximum WTP values with respondent household income, it becomes clear that respondents are not willing to pay more than 2 to 3 percent maximum of their annual disposable household income for the protection of the North Sea. The average household is willing to pay around 0.3 percent for both management scenarios.

An interesting finding is that we are unable to detect any significant differences for the open-ended maximum WTP for the two different management scenarios between the various provinces, also not for the relative WTP values⁸. When pooling the data into North Sea bordered provinces and non-North Sea bordered provinces, we still find no significant differences for protected status with limited use, but we now find a significant difference between mean WTP for a fully protected status between the North Sea bordered provinces Noord-Holland, Zuid-Holland and Zeeland and the rest of the country⁹.

⁷ T-value = 2.308 ($p < 0.09$).

⁸ Using the non-parametric Kruskal-Wallis test. The outcome of the Kruskal-Wallis chi-square test statistic is 7.564 ($p < 0.75$) for both management scenarios.

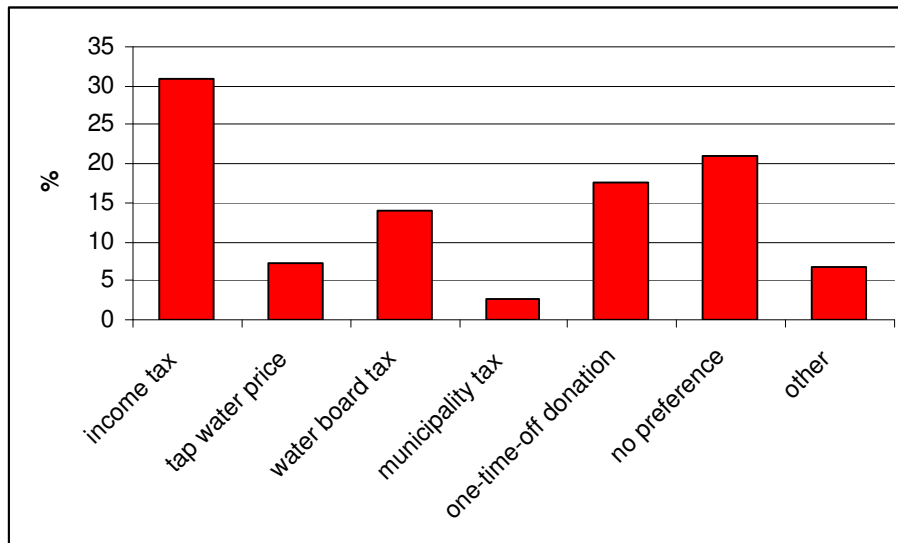
⁹ The Mann-Whitney Z value is -0.198 ($p < 0.85$) when testing the difference between both groups for the open-ended WTP values for protected status with limited use and -2.114 ($p < 0.04$) for a fully protected status.

Table 3.4: Relative maximum open-ended WTP results compared to respondent household income (in % share of annual disposable household income) for both North Sea management scenarios

	Protected areas with limited use	Fully protected areas
Mean WTP	0.28	0.35
Standard error	0.02	0.03
95% confidence interval	0.25 – 0.32	0.30 – 0.40
Min – max values	0 – 2.78	0 – 3.33
Number of observations	410	289

Finally, when asking beach visitors how they prefer to pay (income taxation being the payment vehicle for the DC and open-ended WTP questions), income taxation appears to be, as expected (see Brouwer et al., 2006), the most preferred mode of payment by one third of the sample population (Figure 3.16). Twenty percent has no specific preference, while around 15 percent prefer to donate once and another 15 percent through their water board taxes. Over 5 percent prefers to pay through an increase of the tap water price.

Figure 3.16: Most preferred payment mode for protection and sustainable management of the North Sea



3.4.4 Total economic value

The total economic value (TEV) is found in theory by aggregating the average WTP value across all households in the Netherlands, assuming that the sample population in this study is representative for the whole Dutch population. We saw in section 3.1 that this assumption is fairly accurate. We also saw in section 2 that households from Zeeland are overrepresented and households from Zuid-Holland somewhat underrepresented due to the stratified sampling procedure, but the sample is otherwise representative in terms of important factors such as household size and composition and household income. Assuming that also public preferences for the two management options can be extended to the whole Dutch population, an annual TEV is calculated for both management scenarios (Table 3.5). Based on the most conservative and precise open-ended maximum WTP results, an annual TEV of roughly between 220 and 270 million euros can be achieved for protected status with limited use and between 165 and 210 million euro for a fully protected status of the North Sea. Discounted over for example a 10-year time period at a conventional discount rate of 4 percent, a total present value is found between 1.9 and 2.3 billion euro for the former and between 1.4 and 1.8 billion euro for the latter management option.

Table 3.5: Total economic value aggregation procedure for the whole country

Step		Protest& missing	Preference cur- rent situation	Preference limited use	Preference fully protected
1	Observations in sample	14.1%	2.7%	49.7%	33.4%
2	Corresponding observations in to- tal population (10^3 households)	1,000	191	3,524	2,368
3	Average WTP (€/household/yr)	-	0	70	80
4	TEV ($\text{€}10^6/\text{yr}$)	-	0	246.7	189.5
5	95% confidence interval ($\text{€}10^6/\text{yr}$)	-	0	222.4 – 271.0	167.2 – 210.8
6	Present value TEV (95% ci) (4%; 10 yrs) ($\text{€}10^6$)	-	0	2,081 (1,876 – 2,286)	1,598 (1,410 – 1,778)

3.4.5 External validation checks

Although the questionnaire was thoroughly pretested (see Brouwer et al. 2006 for more details), external validity checks are nevertheless included to assess respondent experiences answering especially the WTP questions. Besides the important protest rate a number of additional indicators are used to evaluate the external validity of the CV study. External validity refers to the extent to which the imposed economic valuation task is considered by those who participate in it as valid and legitimate, and hence the results reliable. The indicators are summarized in the figures below.

Respondents are asked how difficult they find it to answer the posed WTP questions (Figure 3.17) and how clear it is what they are asked to pay for exactly (Figure 3.18). Other questions relate to the impact of the presented information, whether respondents feel the quantity and quality of the information suffices to answer the WTP questions (Figure 3.19) and what the impact of the provided information is on their stated WTP (Figure 3.20).

Figure 3.17: Difficulty experienced in answering the WTP questions

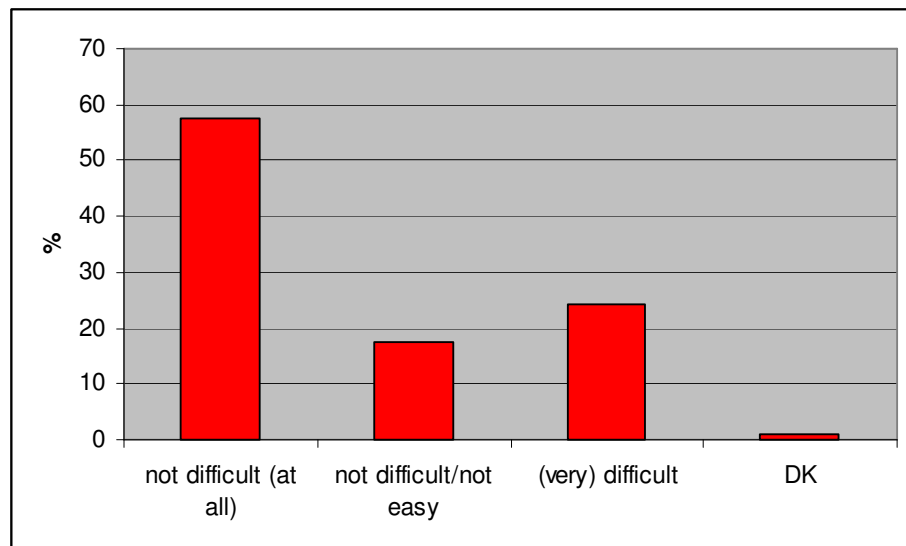


Figure 3.18: Clarity of the WTP questions

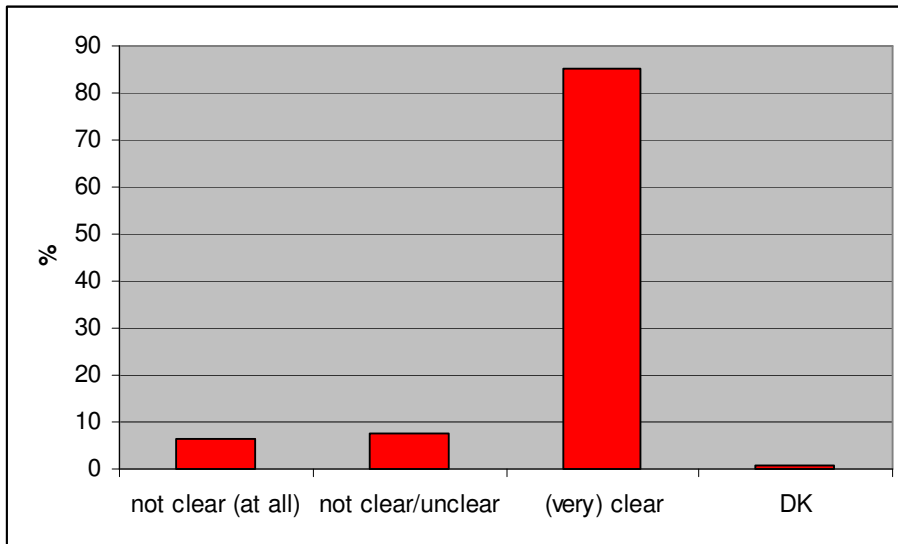


Figure 3.19: Extent to which presented information is considered sufficient to answer the WTP questions

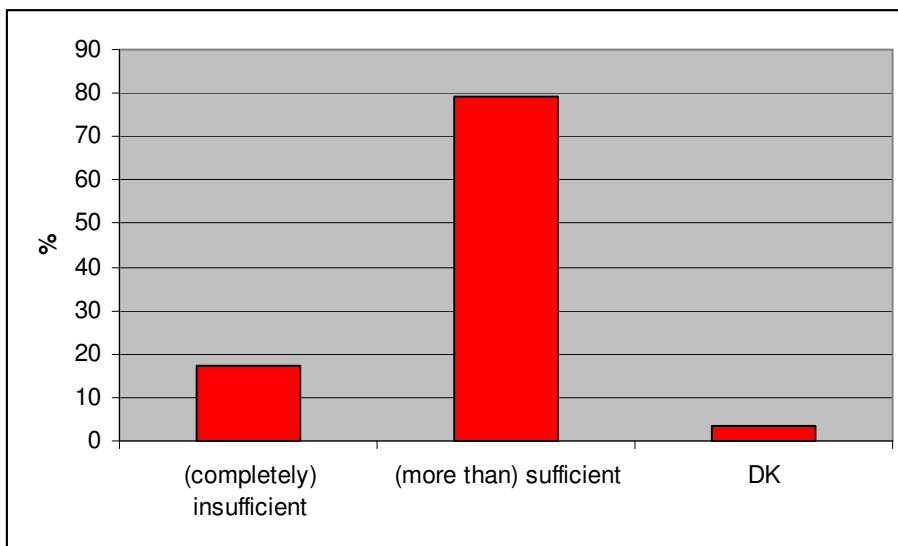
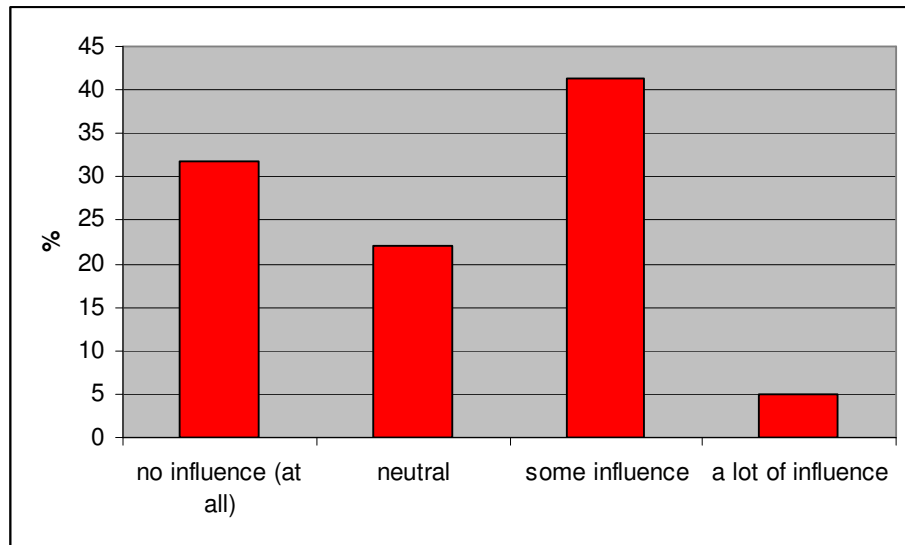


Figure 3.20: Impact of the presented information on stated WTP



As can be seen from the figures above, a majority of almost 60 percent of the respondents indicates to experience no problem answering the WTP questions. Eighty-five percent say that it is clear what exactly they are being asked to pay for, and 80 percent feel that the presented information is sufficient or even more than sufficient to answer the WTP questions. Finally, one third claims that the presented information has had no influence on their stated WTP. Forty percent say that it has influenced their WTP somewhat. Five percent claim that the presented information has had a lot of influence on their WTP reply.

4. Conclusions

The main objective of this study is to assess the public benefits associated with the protection and sustainable management of the North Sea. For this purpose, 7000 questionnaires were sent out to a random selection of households in addition to the 600 face-to-face beach interviews carried out with beach visitors in August 2006 at 10 different beaches along the Dutch North Sea coast and on the island of Texel. Although the response rate is low (17%), the sample is fairly representative in terms of household size, composition and income.

About one in every third household believes that the North Sea water is currently clean, while 15 percent say it is polluted. Ten percent do not know. The North Sea is considered most clean in Zeeland. A large share of almost 45 percent of all households has no idea how seawater quality has changed (or not) over the past 10 years. A quarter believes that the seawater quality has improved, while 20 percent think it has not changed and between 10 and 15 percent think it has deteriorated. More than half of all households feel insufficiently informed about the quality of the North Sea. A majority of 80 percent of all households believe that the protection of the natural areas in the North Sea is equally as important as the protection of natural areas on land such as the Dutch National Parks 'De Veluwe' and 'De Biesbosch'. Fifteen percent even think that the protection of the North Sea is more important, while less than 10 percent say this is less important.

Besides a baseline scenario, respondents were presented with two possible future development scenarios for the protection and sustainable management of the North Sea: one where ecologically valuable and vulnerable areas are designated as protected marine parks with limited economic activity and one where the same areas are fully protected and no economic activities are allowed at all. The basic idea behind the survey is simple. A simple public choice model is introduced to households in which they are asked as tax payers to decide which future management scenario of the North Sea they consider worth pursuing and most valuable. Choosing continuation of the current situation (baseline scenario) is also possible.

Most beach visitors prefer a protected status with limited use. More respondents in the mail survey than in the face-to-face interviews prefer a fully protected status for the designated valuable and vulnerable natural areas. Less than 5 percent of the Dutch households prefer continuation of the current situation.

A majority of two thirds is also willing to pay for the protection and sustainable management of the North Sea in principle. The most important reasons why households are willing to pay are their concern for the environment in general and future generations. Average willingness to pay per household per year varies between 70 euro for protected areas with limited use and 80 euro for fully protected areas. These money amounts are higher than the average values found in the first survey with face-to-face interviews because of the fact that a different parametric estimation procedure was used in the national survey. The average WTP values are lower, however, than the average WTP found in 2003 for the implementation of the WFD in the Netherlands (€105/household/year) (Brouwer, 2006).

Comparing the stated open-ended WTP amounts with respondent household income, most respondents state a maximum WTP value, which does not exceed more than 0.3 percent of their annual household income. Seventy-five percent is not willing to pay more than 0.5 percent of their annual household income. Households are willing to pay on average not more than 0.2 to 0.3 percent of their annual household income extra just for the protection of the North Sea. As in the first survey, we also observe here a significant difference between stated WTP for a fully protected status with no economic use and a protected status with limited use. The latter is lower than the former, but not very much. Combined with the results found for respondent motivation to pay it seems that public willingness to pay consists for a large part of non-use values. Although as much as 90 percent of the respondents say that they know exactly what they are being asked to pay for, most respondents are primarily motivated by a concern about the environment in general. Also concern about the environmental legacy of the current generation to future generations plays a role.

Finally, the external validity and reliability of the study was tested by investigating respondent perception of the WTP questions. Examining the number of protest bids against the WTP question as one of the most important indicators of the study's 'external' validity and reliability, this number appears to be higher in the mail survey (12%) than the face-to-face interviews (7%), possibly as a result of some degree of interviewer bias. A majority of almost 60 percent of the respondents experience no problem answering the WTP question. Eighty-five percent say that it is clear what exactly they are being asked to pay for, and 80 percent feel that the presented information is sufficient or even more than sufficient to answer the WTP questions. Some indication of constructed preferences is found given that 40 percent of the respondents claim that the presented information has somewhat influenced their stated WTP. One third claims that the presented information has had no influence on their stated WTP.

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